





Geographic distribution of pocket gophers (Rodentia, Geomyidae) of Honduras

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Abstract. Three species of pocket gophers, family Geomyidae, have been reported from Honduras. We summarize and update the distribution of these species based on burrow observations, sightings, photographs, and a voucher specimen, most of which were obtained during surveys conducted between 2011 and 2022. We report one new, eastern most locality for *Heterogeomys hispidus* from the Department of Atlántida, a specimen of *Orthogeomys grandis* from the Department of La Paz, and 17 additional localities for geomyids. These include records located on the Caribbean versant of the Sierra Madre along the Río Ulúa and between the documented distributions of *H. hispidus* and *O. grandis*, and records between the known distributions of *H. hispidus* and *H. cherriei*. These observations provide an excellent opportunity to examine the relative ecological limits of the three taxa.

Keywords. Burrows, Central America, *Heterogeomys*, *Macrogeomys*, *Orthogeomys*

Academic editor: William Tavares

Received 16 October 2022, accepted 17 August 2023, published 30 August 2023

Gómez-Corea WN, Marineros L, Vega HL, López-Aguilar TP (2023) Geographic distribution of pocket gophers (Rodentia, Geomyidae) of Honduras. Check List 19 (4): 581–588. <https://doi.org/10.15560/19.4.581>

Introduction

The pocket gophers (Rodentia, Geomyidae) have a widespread distribution from southern Canada to north-western Colombia (Hall 1981; Alberico 1990). Two of the seven recognized genera and all three of the Middle American subgenera reach their distributional limits in Honduras (Fig. 1A): *Orthogeomys grandis* (O. Thomas, 1863), the sole species in the genus; *Heterogeomys hispidus* (Le Conte, 1852) in the subgenus *Heterogeomys*; and *H. cherriei* (J. A. Allen, 1893) in the subgenus *Macrogeomys* (Hafner 2016; Spradling et al. 2016). These three species have been documented by museum voucher specimens from only six localities in Honduras: three for *H. hispidus*, two for *H. cherriei*, and one record for *O. grandis*.

Knowledge of pocket gophers is limited by their fossorial habits, as they spend practically their entire lives in subterranean tunnels excavated for breeding, depositing waste, and catching food (Reichman et al. 1982; Sisk and Vaughan 1984; Andersen 1987). Their presence is signaled by their distinctive mounds of fresh earth pushed up from burrow excavation. We update the geographic distribution of Honduran pocket gophers based on photographs, burrows, sightings, and a museum voucher.

Methods

We downloaded from VertNet version 2016-09-29 (VertNet 2016; downloaded May 2023) records of geomyids from Honduras and neighboring countries to

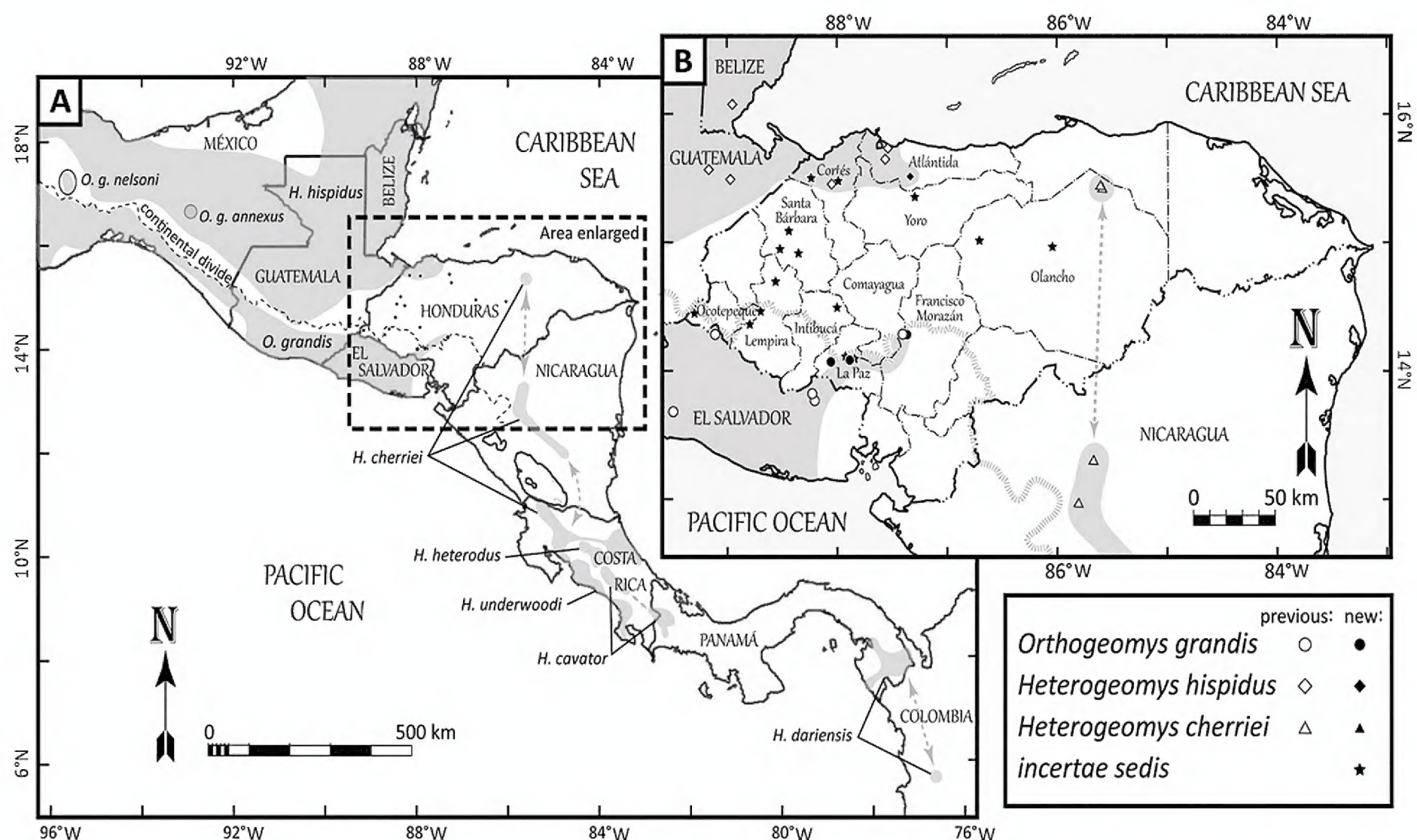


Figure 1. Geographical distributions (shading) of pocket gophers. **A.** Central America (modified from Hall 1981 and Hafner 2016). **B.** Detail of records in departments of Honduras.

update and refine the documented distribution in Central America (Hall 1981), surveyed the literature for reported sightings of geomyids in Honduras, and collated burrow observations, animal sightings, and photographic records from iNaturalist (2020, 2021, 2023) and opportunistic field research conducted by us between 2011–2022. This fieldwork included monitoring programs in four protected areas: Reserva Biológica Volcán Pacayita, Parque Nacional Montaña de Celaque, Refugio de Vida Silvestre Montaña de Puca, and Reserva Biológica Guajiquiro.

Three specimens were captured using standard trapping methods approved by the American Society of Mammalogists (Sikes et al. 2019) under the authority of a scientific permit issued by the Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF), Resolución DE-MP-067-2018. Coordinates and elevation were recorded in the field using a Garmin eTrex 10 GPS receiver (using the WGS84 datum and elevations in meters, rounded to the nearest 10 m). Two specimens of *H. hispidus* were measured externally (head–body length, tail length, hind foot length, and ear length, in mm), weighed (in g), and released. One specimen of *O. grandis* was retained and a skull-only voucher was deposited in the Museum of Natural History of the Universidad Nacional Autónoma de Honduras (MUVS-V). Eleven cranial measurements were taken with digital calipers following Spradling et al. (2016): occipito–nasal length (ONL), rostral width, nasal length, width of interorbital constriction (IOC), zygomatic breadth, cranial width (CW), diastema length, length of maxillary toothrow (MTR), occlusal length of upper molars 1 and 2, occlusal length of

upper molar 3, and total length of the mandible. Age was determined by fusion of the exoccipital–supraoccipital and basioccipital–basisphenoid sutures following Daly and Patton (1986). Box plots (SYSTAT version 7.0, Wilkinson 1997) were used to visualize external and cranial measurements of new specimens relative to mensural data for *O. grandis* and *H. hispidus* (Spradling et al. 2016; data provided by D.J. Hafner pers. comm., 15 May 2023).

Results

Here, we list 19 records for pocket gophers from Honduras in addition to the previous six museum records (Fig. 1B, Table 1). These records include five published reports of the characteristic burrow mounds of pocket gophers or direct observations of pocket gophers (some with accompanying photographs) from Cortés, La Paz, Ocotepeque, and Olancho departments (Marineros 1998; Marineros and Martínez-Gallegos 1998; Herrera et al. 2005; Hoskins et al. 2018); three photographs of geomyids reported online from localities in the departments of Francisco Morazán (iNaturalist 2023; Fig. 2A), La Paz (iNaturalist 2021; Fig. 2B), and Santa Bárbara (iNaturalist 2020; Fig. 2E), and 11 new records based on our fieldwork. These new records include a museum voucher (La Paz department), two photographs (Atlántida and Lempira departments), and eight observations (Cortés, Intibucá, Lempira, Olancho, Santa Bárbara, and Yoro departments).

Four of the 19 new records can be identified with confidence to species based on photographs, external measurements, and cranial characters. Of the 15

Table 1. Records for pocket gophers (family Geomyidae) from Honduras are listed by department within species for verified identifications (letters, mapped in Fig. 5) or as *incertae sedis* observations including sightings, burrow mound observations, and photographs identified only to the family (numbered, mapped in Fig. 5). Voucher specimens are stored in the American Museum of Natural History (AMNH); Carnegie Museum of Natural History (CM), Charles R. Conner Museum, Washington State University (CRCM); Museum of Comparative Zoology, Harvard University (MCZ); National Museum of Natural History, Smithsonian Institution (NMNH); Biodiversity Research and Teaching Collections, Texas A&M University (TCWC), and the Museum of Natural History of the Universidad Nacional Autónoma de Honduras (UNAH and MUVS-V).

Code	Department	Locality	Latitude	Longitude	Elev. (m)	Voucher	Reference
<i>Orthogeomys grandis</i>							
A	Francisco Morazán	Cerro Cantoral, Distrito Central				AMNH 123386, 123387, 123388, 124833; MCZ 29038, 29039, 29040	VertNet
B		Reserva de Vida Silvestre Corralitos	14.3296°N	087.3513°W	1690	Photograph	iNaturalist 2023
C	La Paz	Buenos Aires, Guajiquiro	14.1149°N	087.8461°W	2060	MUVS–V–2210	This study
D		El Mezcalito, Marcala	14.0973°N	088.0200°W	1680	Photograph	iNaturalist 2021
<i>Heterogeomys (Heterogeomys) hispidus</i>							
E	Atlántida	San Alejo, Tela				CRCM 65-107, 65-137	VertNet
F		Tela				TCWC 12570, 12571, 12572, 12753	VertNet
G		Aldea el Jilamito, Arizona	15.5702°N	087.3340°W	140	Photograph	This study
H	Cortés	San Pedro Sula				NMNH 19468	VertNet
<i>Heterogeomys (Macrogeomys) cherriei</i>							
I	Olancho	Santa María del Carbón	15.30°N	085.85°W		UNAH	McCarthy et al. 1991
J		8 km (along Trujillo Highway) Santa María del Carbón (jct. Río Wampu Rd)				CM 118617	D.J. Hafner, pers. comm., 15 May 2023
<i>Incertae sedis</i>							
1	Cortés	Parque Nacional Cusuco	15.5388°N	088.2211°W	2165	Burrow mound	Marineros and Martinez-Gallegos (1998); Hoskins et al. (2018)
2		Villa Julia, San Pedro Sula	15.5228°N	087.9834°W	50	Burrow mound	This study
3	Intibucá	Jesús de Otoro	14.5240°N	087.9711°W	895	Burrow mound	This study
4	La Paz	Las Trancas, Opatoro	14.1288°N	087.8802°W	2165	Burrow mound and sighting	Marineros and Martinez-Gallegos (1998); this study
5		El Recibimiento, Guajiquiro	14.1164°N	087.8194°W	1740	Burrow mound	Marineros (1998)
6	Lempira	Refugio de Vida Silvestre, Montaña de Puca	14.7225°N	088.5374°W	1550	Photograph	This study
7		Parque Nacional Montaña de Celaque	14.4782°N	088.6630°W	1170	Burrow mound and sighting	This study
8		Reserva Biológica Volcán Pacayita	14.3716°N	088.7615°W	1865	Burrow mound and sighting	This study
9	Ocotepeque	Parque Nacional Montecristo Trifinio	14.4667°N	089.2694	1450	Burrow mound	Herrera et al. (2005)
10	Olancho	Parque Nacional la Muralla	15.0498°N	086.7284°W	1130	Burrow mound	This study
11		Agalta, Gualaco	15.00241°N	086.0620°W	630	Burrow mound	Marineros and Martinez-Gallegos (1998)
12	Santa Bárbara	San Luis	15.1173°N	088.4378°W	880	Burrow mound and sighting	This study
13		Atima, Pencaligue	14.9789°N	088.4909°W	690	Photograph	iNaturalist 2020
14		San Nicolas	14.9437°N	088.3255°W	620	Burrow mound and sighting	This study
15	Yoro	Sinaí, Locomapa	15.3939°N	087.2758°W	1320	Burrow mound	This study



Figure 2. Photographs of pocket gophers from Honduras. **A.** *Orthogeomys grandis* from Reserva de Vida Silvestre Corralitos, Francisco Morazán. **B.** *O. grandis* from Marcala, La Paz. **C.** *Heterogeomys hispidus* with typical pelage from Arizona, Atlántida. **D.** *Heterogeomys hispidus* with white lumbar belt from Arizona, Atlántida. **E.** *Incertae sedis* pocket gopher from Atima, Santa Bárbara. **F.** *Incertae sedis* pocket gopher from Refugio de Vida Silvestre Montaña de Puca, Lempira. Photo credits: Jeff Canaca, iNaturalist 2023 (A); Roger Vásquez, iNaturalist 2021 (B); Leonel Marineros (C, D); Estefania Calix, iNaturalist 2020 (E); Hermes Vega (F).

remaining reports of pocket gophers that cannot be identified confidently to species, 12 are between the distributions of *H. hispidus* and *O. grandis* (Fig. 1B). Of these 12, two are within the known distribution of *H. hispidus* in Cortés department on the Caribbean versant, five are on the Pacific versant of the Sierra Madre in Ocotepeque, Lempira, and La Paz departments, and five are along the drainage of the Río Ulúa in Santa Bárbara, Lempira, and Intibucá departments, between the distributions of the two species. Three other localities are between the distributions of *H. hispidus* and *H. cherriei* in Olancho and Yoro departments.

Orthogeomys grandis (O. Thomas, 1863)

Figure 3, Table 1

New records. HONDURAS – **La Paz** • Guajiquiro, Aldea, Buenos Aires; 14.1149°N, 087.8461°W; 2060 m a.s.l.; 17.II.2022; W. Gómez-Corea leg.; 1 adult ♂, MUVS-V-2210. El Mezcalito, Marcala (14.0973°N, 088.0200°W; 1680 m; photograph, iNaturalist 2021) – **Francisco Morazán** • Reserva de Vida Silvestre Corralitos (14.3296°N, 087.3513°W; 1690 m; photograph; iNaturalist 2023).

Identification. The voucher specimen is larger than most *H. hispidus* (Fig. 4A, B), and we identified it as *O. grandis* following the key by Spradling et al. (2016): IOC > 11.9 mm (15 mm), CW > 28.2 mm (33 mm), and post-orbital process inconspicuous to nearly absent. Two of the photographs from localities near voucher-documented localities of *O. grandis* (Reserva de Vida Silvestre Corralitos, Francisco Morazán, Fig. 2A; El Mezcalito, Marcala, La Paz, Fig. 2B) show the

pelage characters of *O. grandis* and may be confidently assigned to that species (D.J. Hafner pers. comm., 15 May 2023).

Distribution. This species is now known in Honduras from four localities in two departments: La Paz and Francisco Morazán. The observations from the Pacific versant of Ocotepeque (Herrera et al. 2005), Lempira, Intibucá, and La Paz (Marineros 1998; Marineros and Martínez-Gallegos 1998; this study) departments are likely *O. grandis*.

Heterogeomys hispidus (Le Conte, 1852)

Figure 2C, D, Table 1

New record. HONDURAS – **Atlántida** • Arizona, Aldea el Jilamito; 15.7502°N, 087.3339°W; 140 m a.s.l.; 7.VI.2011; L. Marineros obs.; 1 sex indet, 1 ♀.

Identification. Records from Jimalito (Fig. 2C, D) are clearly *H. hispidus* based on external measurements and pelage characteristics (Reyd 2009; Spradling et al. 2016). The average head-body and tail length of the two specimens are smaller than those for *O. grandis* and more similar to those of *H. hispidus* (Fig. 4C, D), and one of the two specimens possesses the distinctive white lumbar belt (Fig. 2D) that was found in 16% of 234 individuals and a third of 45 populations of *H. hispidus* but never in *O. grandis* (Hafner and Hafner 1987).

Distribution. This species is now known in Honduras from four localities in two departments: Atlántida, and Cortes. The observations from Cortés and Yoro departments, within or near the known distribution of *H. hispidus*, likely belong to this species.



Figure 3. Skull of *Orthogeomys grandis* (MUVS-V-2210), collected in Buenos Aires, Guajiquiro, La Paz, Honduras. **A.** Cranium in dorsal view. **B.** Ventral view. **C.** Lateral view with mandible.

Discussion

Hafner and Hafner (1987) expanded the documented distribution of *Heterogeomys* subgenus *Macrogeomys* in Costa Rica and Panamá, and Alberico (1990) extended the range of this subgenus into Colombia. McCarthy et al. (1991) reported a specimen of *H. cherriei* from northeastern Olancho Department, 235 km north of the nearest record in Nicaragua, and Spradling et al. (2016) reported a second specimen from a nearby locality. The updated and refined distribution of the three subgenera of pocket gophers in Central America (Fig. 1A) indicates that *O. grandis* is generally restricted to the Pacific versant, only crossing the continental divide of the Sierra Madre del Sur in Oaxaca (*O. g. nelsoni*, restricted to the vicinity of Cerro Zempoaltepetl) and Chiapas (*O. g. annexus*, known only from Tuxtla Gutiérrez). *Heteromys hispidus* has been found only on the Caribbean versant, nearing the continental divide in southern Guatemala.

The few museum records of geomyids from Honduras might initially be viewed as cause for concern, indicating that their populations may be at risk. The

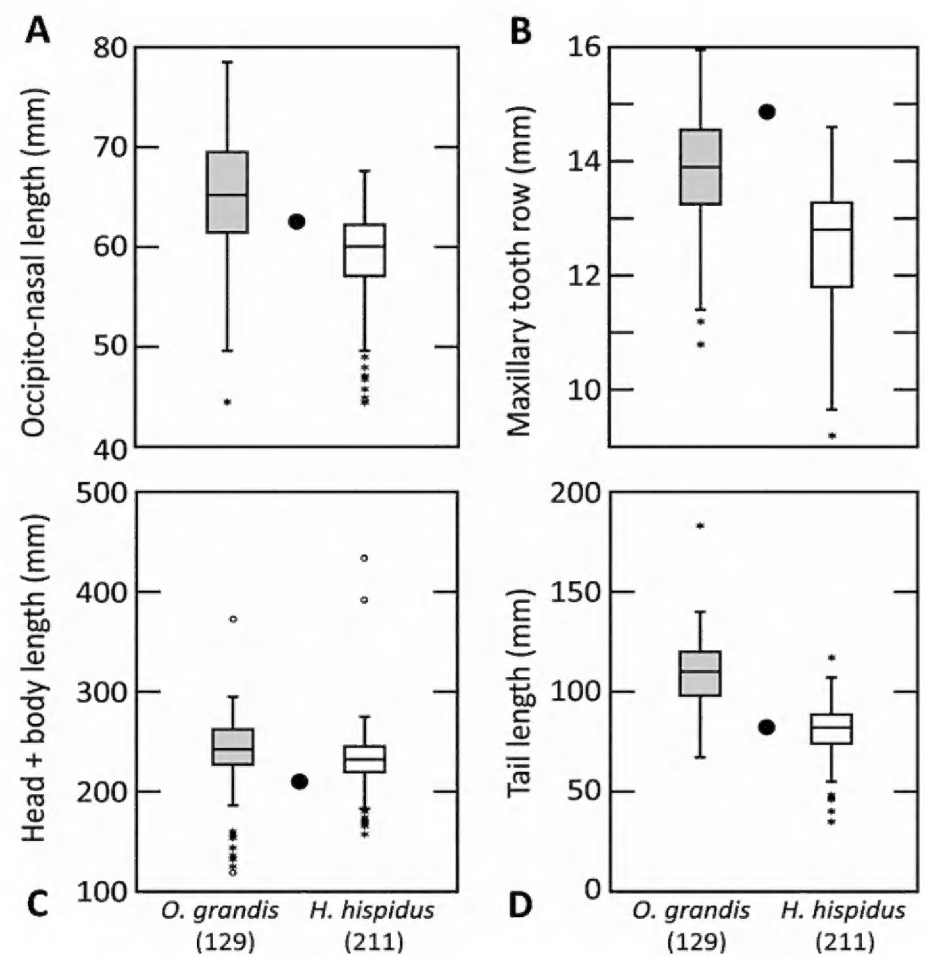


Figure 4. **A, B.** Comparison of cranial measurements of MUVS-V-2210 from Buenos Aires, Guajiquiro, La Paz (filled circle), with those of *O. grandis* and *H. hispidus*. **C, D.** Comparison of average external measurements of two specimens from Arizona, Atlántida, with those of *O. grandis* and *H. hispidus*.

Wildlife Conservation Society has assessed *O. grandis* as Near Threatened in Honduras, but considered both *H. hispidus* and *H. cherriei* as Data Deficient (WCS 2021). All three species are considered to be of Least Concern globally (Cassola 2016; Vázquez et al. 2016a, 2016b) on account of their wide distribution, presumed stable populations, and tolerance of a wide variety of habitats.

The relative rarity of museum records of Central American pocket gophers reflects the relative lack of effort and difficulty in capturing these species rather than actual rarity, based on extensive collecting efforts by M.S. Hafner, D.J. Hafner, and J.C. Hafner in Mexico, Belize, Costa Rica, and Panama from 1977 to 2013 (D.J. Hafner pers. comm., 15 May 2023). By searching for fresh burrow mounds and asking local farmers, they were usually able to locate pocket gophers, which were often considered pest species by the farmers and ranchers; pocket gophers consume garden plots and commercial crops, or produce large and deep burrows posing dangers for dairy cattle. Compared to the smaller-bodied North American genera, the larger *Orthogeomys* and *Heterogeomys* occur in smaller, generally more dispersed populations and appear to be far less responsive to traps. For example, the small and pugnacious *Thomomys bottae* (Eydoux & P. Gervais, 1836) responds quickly to an open burrow (sometimes as the burrow is opened) and are often trapped within an hour, while traps placed in burrows of *Orthogeomys* or *Heterogeomys* sometimes remained untouched for days before a successful capture. Trapping data compiled from 1977 to 1997, including a total of 1726 set-days (a set being two traps set for 24 hours) and 636 captures across 15

species and six genera of pocket gophers (D.J. Hafner pers. comm., 15 May 2023) documented a marked contrast in trapping success between the generally smaller North American genera (50.0–59.3% trap success for *Thomomys*, *Geomys*, and *Cratogeomys*) and the generally larger genera from southern Mexico and Central America (4.8–8.0% trap success for *Zygoeomys*, *Orthogeomys*, and both subgenera of *Heterogeomys*).

It is difficult to distinguish *H. hispidus* and *O. grandis* by pelage characters alone due to the extreme variation in hair density and color, particularly in *O. grandis*. The pelage of *O. grandis* from higher elevations (>1000 m) is dense, woolly, and dark brown to nearly black, but at lower elevations animals appear nearly naked due to the sparse pelage, while most *H. hispidus* have coarse, short, and extremely sparse pelage that never approaches the appearance of nakedness seen in lowland populations of *O. grandis* (Reid 2009; Godinez and Guerrero 2014; Spradling et al. 2016). Photographs of the specimens from higher elevations (>1500 m) in the departments of Francisco Morazán and La Paz (Fig. 2A, B) resemble voucher specimens of *O. grandis* from nearby localities, and so they are confirmed here as *O. grandis*. Similarly, the two specimens from Arizona, Atlántida (Fig. 2C, D) have pelage typical of voucher specimens of *H. hispidus* from nearby localities, and so are confirmed here as *H. hispidus*. Specimens from lower elevations (<1500 m) of Santa Bárbara and northern Lempira departments have sparse pelage (Fig. 2E, F) but the photographs are not sufficiently clear to distinguish between the two species.

The distribution of *H. cherriei* was originally associated with the Caribbean lowlands of Costa Rica. Hafner (1991) suggested that the morphologically and ecologically similar *H. matagalpae* of the Nicaraguan Caribbean lowlands might be conspecific with *H. cherriei*, and Spradling et al. (2016) found that *H. cherriei* and *H. matagalpae*, including new records from Honduras (McCarthy et al. 1991), were indeed conspecific based on sequences from three mitochondrial and two nuclear genes, cranial morphology, and ectoparasites. We have documented the presence of *H. hispidus* farther east in the Atlántida department, and museum vouchers should be obtained from the burrow observations in Yoro and Olancho departments to establish the relative distribution of *H. hispidus* and *H. cherriei* in Honduras. As *H. cherriei* occurs in the lowlands of Costa Rica, from near sea level to about 1000 m, it seems reasonable that *H. cherriei* will eventually be found to occur throughout the Caribbean lowlands of eastern Nicaragua and Honduras, collectively known as La Moskitia.

Positive identification of pocket gophers from the localities in the Río Ulúa watershed, between the distributions of *H. hispidus* and *O. grandis*, and from the localities in Olancho department between *H. hispidus* and *H. cherriei*, are needed to define the relative distributions of the three subgenera in Honduras (Fig. 5). Although *H. hispidus* is more commonly found in Caribbean lowlands, it extends high up into the central

highlands in Mexico, and one of the two burrow sightings in Cortés department (presumably *H. hispidus*) is from 2165 m elevation. The other species in the subgenus, *H. lanius*, has been found as high as 3010 m on the southeastern slopes of Pico de Orizaba (Hafner et al. 2014). On the other hand, *O. grandis* is already documented to have spilled over into the Caribbean versant in Oaxaca and Chiapas, Mexico, and may have descended from the Sierra Madre into the Caribbean versant of Honduras along the Río Ulúa.

Hall (1946: 371) maintained that “the preferred habitat of a species is most clearly revealed at and near the margin of its geographic range, in which area the population of a species faces hostile environments and therefore occupies only the least hostile parts”. The evidence presented here for geomyids occurring between the previously documented geographic ranges for the three subgenera of Central American pocket gophers in Honduras, where each reaches the margin of its range, provides an excellent opportunity to examine their relative ecological limits.

Acknowledgements

We thank A. Corea and D. Gómez for assistance in the field and J. Reyes-Chávez for English review. We acknowledge the Global Environment Facility (GEF) for funding. We also thank to D.J. Hafner and anonymous reviewers for their helpful comments and suggestions on the manuscript.

Author Contributions

Conceptualization: WNGC. Data curation: WNGC. Formal analysis: WNGC. Investigation: WNGC, HV, LM. Supervision: WNGC. Writing – original draft: WNGC. Writing – review and editing: WNGC, LM, HV, TPL.

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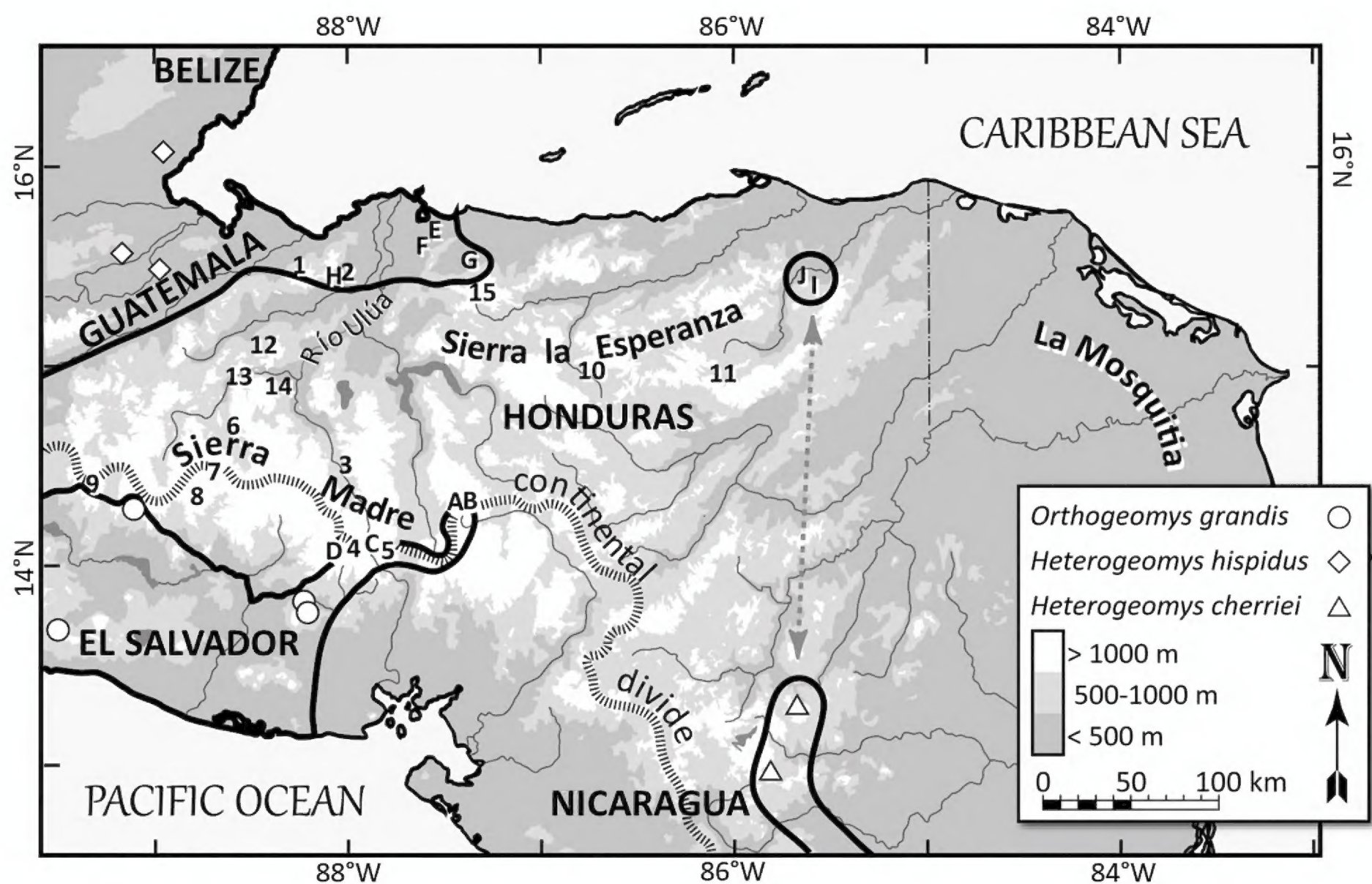


Figure 5. Updated distribution map of pocket gophers in Honduras relative to elevation and the continental divide. Letters correspond to localities assigned to species; numbers correspond to *incertae sedis* localities (see Table 1 for details). The records of neighboring countries are indicated.

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